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Research Paper

Stress recovery in forest or handicraft environments – An intervention study

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ABSTRACT

In modern society stress is a major problem, causing lack of mental and social well-being as well as potential vulnerability to problems at work. Previous studies have found natural environments to be relaxing. In this intervention study, performed in Northern Sweden, the hypothesis was that an outdoor forest environment would be more relaxing than an indoor handicraft environment. Forty-six participants with high stress levels (PSQ ≥ 0.4) (33 women, 13 men, average age 48 years) were randomly assigned to visit either the forest environment (n = 27) or the handicraft environment (n = 19). The participants visited their assigned environment twice a week during three months, either in autumn or spring. During each visit they spent two hours performing, simple and undemanding activities. Psychological health outcomes were measured by the questionnaires CIS, PSQ, SCQ, SMBQ, SF-36 before and after the three months interventions. Sleeping patterns were monitored by an Actiwatch and sleep diary. The participants' mood before and after each visit were estimated by a questionnaire. The results show that the participants' health had improved after the interventions in both the forest and handicraft environments. The sleep latency increased slightly among participants in the handicraft environment. For participants in both environments the levels of fatigue, stress and burnout were all lower. They felt less limitation due to physical problems and did not feel so tired. Also their mental health had improved. From start to end of a visit to either environments the participants' mood was improved, and they felt more relaxed, alert, happy, harmonious, peaceful and clearheaded. Over time during the intervention, they also felt significantly more clearheaded. We conclude that the health of all participants improved, irrespective of the environment visited.

1. Introduction

1.1. Stress and its consequences

In developed countries generally, and Sweden specifically, people are increasingly exposed to stress. Prolonged stress, without opportunities for restoration, can cause chronic fatigue and various other adverse physiological and psychological symptoms (Danielsson et al., 2012). Consequently, mental exhaustion and negative feelings are increasing, people have less energy and are becoming increasingly unhappy, as reported for instance by the Directorate General for Communication of the European Commission (2010). At young age stress can even cause changes in brain morphology and affect functions like learning (Hollis et al., 2013).

Symptoms of stress may include reductions in memory capacity and ability to concentrate, insomnia, and increases in heart rate, headaches and muscular aches (De Vente et al., 2003; Anon., 2003; Anon., 2009; Dahlgren et al., 2005, 2006; Potter et al., 2009). Exposure to stress may also have persistent effects, for example some functional limitations and disabilities at old age may be linked to stress exposure 30 years previously (Kulmala et al., 2013). Consequences of the symptoms may include reductions in functionality both socially and at work (Anon., 2003). Hence, stress is frequently related to people's employment (Lindholm et al., 2005; Milczarek et al., 2009; Anon., 2013), and sick-leave due to mental illness (commonly linked to inability to cope and severe stress) is also increasing among the Swedish population (Anon., 2010; Försäkringskassan 2013). Frequencies of stress-related physical symptoms (severe pain in neck and shoulders, constant fatigue, moderate or severe anxiety and nervousness) are also increasing. Furthermore, recovery from stress-associated fatigue syndromes takes a long time (Vercoulen et al., 1996), and people who have had time off due to stress usually remain more sensitive to stress after returning to work (Anon., 2003). Hence, mental ill-health and musculoskeletal disorders (both of which may be strongly associated with stress) are the two main classes of diagnoses entitling people to disability pensions in Sweden (Danielsson et al., 2012).

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1.2. Theory

Humans evolved in natural environments and it is only in recent centuries that we have lived in towns (Hartig et al., 2011). In that short time we have developed highly mobile, dense, high-tech societies packed with tools that enable us to move through large crowds and execute tasks much more rapidly than before, driving demands for everything to be done faster. We must constantly perform more rapidly, and constantly make quick decisions. However, our brains and physiological systems have not evolved at the same pace as our technology, and we become exhausted when we constantly have to make decisions and perform at our best. This exhaustion can be related to the distinction between spontaneous and directed attention (Kaplan and Kaplan 1989). Focused attention is used when making decisions and requires tiring concentration. It must be used constantly even when moving through busy urban environments simply (for instance) to avoid being knocked down or knocking down someone else. Spontaneous attention refers to noticing something without any need to make decisions, for instance when looking at a view, or simply taking in our surroundings. It is used in natural environments, which are both restful and restorative because they provide precisely the amount of stimuli that we are evolved to handle. Hence, we respond positively to our "original environment", in which everything is understandable, predictable and manageable, we get a sense of coherence and feel safe, and so the environment provides support and is restorative.

1.3. Effects of nature in the neighborhood

In recent years contact with nature has received increasing attention as a way of reducing stress. Green environments offer urban populations opportunities for restoration, and the more time people spend in contact with nature, the less they are affected by stressful events (Hartig et al., 2003; Grahn and Stigsdotter 2003; Ottosson and Grahn 2008). There is also a clear correlation between distances to green areas and people's levels of stress; the further away a green area is situated the higher risk for people to get high stress levels (Hörnsten and Fredman 2000; Nielsen and Hansen 2007; Stigsdotter et al., 2010). Thus, green areas in the neighborhood provide havens from life crises and stress, providing people with places where they can quickly recuperate and prepare for the next challenge (Wells and Evans 2003; Grahn and Stigsdotter 2003). Simply viewing nature from the office window make us more positively disposed towards our work, resulting in less negative reactions towards stressful situations (Kaplan and Kaplan 1989). Similarly, the ability to view nature through a window has highly beneficial effects for patients in hospitals (Ulrich 1984; Raanas et al., 2011), reducing the length of their stays, and requirements for both care from the personnel and analgesics (Ulrich 1984; Kline 2009).

1.4. Effects of nature on stress recovery

People recover from stress, both physiologically and psychologically, more rapidly in green areas than in urban environments (Ulrich et al., 1991; Berto 2005). Similarly, visiting a natural area results in a slower heartbeat, lower blood pressure and cortisol levels in the saliva, more positive thinking, less aggression and fear, more calmness and feelings of refreshment than visiting an urban environment (Ulrich et al., 1991; Juyoung et al., 2009). For people suffering from exhaustion disorder (also known as fatigue or burnout) visits to forest environments are perceived as significantly more restorative, more mood-enhancing and better for restoring attention capacity than city visits (Sonntag-Öström et al., 2014). Furthermore, visiting a natural environment improves people's ability to cope with everyday life by providing better perspectives of what is manageable, and what should be valued (and hence prioritized) in life (Talbot and Kaplan 1986; Nordh et al., 2009; Sonntag-Öström et al., 2014). Pensioners' ability to concentrate also increases, and they feel healthier, if they can spend time out in nature (Ottosson and Grahn 2005).

In addition, the therapeutic and restorative effects of nature are positively correlated with the severity of crises people have experienced (Ottosson and Grahn 2008). Hence, patients suffering from exhaustion disorder are frequently offered garden therapy (Tenngart Ivarsson and Grahn, 2010), in which several "rooms" with different characteristics, activities and atmospheres may be provided (Stigsdotter and Grahn, 2002). Some "rooms" offer peace and quiet, with no activity, while others encourage activities. In the beginning of the treatment many patients prefer to stay in the wildest and woodiest part of the garden (Tenngart Ivarsson and Grahn, 2010). Heavily exhausted patients also choose the most forested parts with no activities. The trees fascinate and give a sense of safety that is lacking in everyday life. Regular visits to boreal forest environments may also enhance the mood of patients with exhaustion disorder. For example, after a two hour forest visit in solitude, patients who participated in studies presented by Sonntag-Öström et al. (2015a) felt more relaxed, alert, clear-headed, peaceful, happier and more harmonious.

Nature based therapy includes green nature, physiotherapy, conventional therapy, socializing, stress management, relaxation and creative activities as handicraft and gardening (Sahlin et al., 2015a, 2015b; Pálsdóttir et al., 2014). This mix of activities in a green environment has been found to be successful in rehabilitation from stress (Adevi and Lieberg, 2012).

1.5. Creative environments

Environments can support restoration by absence of demands (i.e. emotional demands, noise or crowds) or contain qualities that support restoration (von Lindern et al., 2017). Environments that are not natural can support restoration and offer relaxation, particularly those that promote creative engagement, which reduces stress, anxiety and mood disturbances (Stuckey and Nobel 2010). For example, when people work with clay they not only physically create objects and feel the clay in their hands, but also mentally plan what to do next and observe the object being produced and finished. Thus, it activates people's body and minds (Sholt and Gavron 2006), without making excessive demands. Anthroposophical art therapy reduced cancer patients' depression levels (Bar-Sela et al., 2007), and increased levels of well-being, confidence, motivation self-care and social relationships of persons with mental illness (Allan et al., 2015). Participating in community arts programs increased mental health and well-being for persons from disadvantaged backgrounds (Kelaher et al., 2014). Some regarded the creative activities as improving the self-management of mental health (Lawson et al., 2014). A collaborative art-making task reduced stress levels and increased social support in a group of hospice caregivers (Salzano et al., 2013). Consequently, several kinds of environment other than nature can have helpful effects for people suffering from stress, based on the activities performed in them. However, it has been argued that human beings have preference for nature environments and that this preference has evolutionary origin and therefore is innate (Appleton 1975; Orians 1980; Wilson 1984). Physical activities in natural outdoor environment improves restoration and mental health better than indoor activities (Mitchell 2012; Weng and Chiang 2014; Rogerson et al., 2016). Therefore, we hypothesized that nature in the form of an outdoor forest environment would promote recovery from stress better than an indoor environment.

Our aim was to examine if two different environments, an outdoor forest and an indoor handicraft environment, have unique effects on stress recovery in addition to comparable activities performed in them; and if so, the possible reason to this. The aim was also to study if there were any differences in the environments where the activities were performed.

2. Materials and methods

2.1. Study population

The study population was recruited through advertisements in daily papers, on public billboards at the University and in supermarkets and by recommendations from the human resources managers at the University and the municipality of Umeå. After presentation of verbal and written information regarding the study, 101 persons registered their interest to participate and were screened for participation between the years 2009 and 2012. The inclusion criteria were: a) level of stress ≥ 0.4 according to the PSQ-scale (Perceived Stress Questionnaire) (Levenstein et al., 1993), and b) age between 18 and 65 years. The age span was chosen to correspond with what is considered working age in Sweden. The exclusion criteria were: a) known alcohol or drug abuse, b) other previous or ongoing participation in intervention studies, or c) mobility impairment. Eighty-four persons met the criteria and were randomly assigned either to an outdoor group visiting a green forest environment or an indoor group visiting a non-green handicraft environment. Thirty-eight of them declined to participate just before the start or during the early part of the intervention for work or personal reasons. According to new rehabilitation rules (which coincided with the start of the project) persons on sick leave were in some cases forced to participate in certain activities which could not be combined with participation in the research project. The study was approved by The Research Ethics Committee of Umeå University (Dnr 2010-74-32 (Dnr 08–110 M)).

2.2. Final study population

The final study population consisted of 46 participants, of whom 27 visited the forest environment and 19 visited the handicraft environment. As shown in Table 1, the participants included 33 women and 13 men, with an average age of 48 years. All of them had finished secondary school and 23 had a university degree. Nine were working, eight were unemployed and three were students. Employers of those at work were not registered. Twenty-six were on part-time or full time sick leave. A prerequisite for participation in the study was that participants could allocate two half days per week to the study. This resulted in the high amount of participants on sick leave.

2.3. Experimental design

The intervention lasted for 12 weeks with 3–4 h visits, twice a week during either autumn or spring (usually from the middle of September to the middle of December, or from the middle of March to the middle of June). In each of these seasons, a group of 2–7 participants visited the forest environment and another group visited the handicraft environment, accompanied by a group leader, in the middle (brightest part) of the day. The participants in the forest group were picked up in the center of Umeå by the group leader and brought to the forest by car. In this way it was ensured that both the forest and handicraft group put as little effort as possible to make their way to the environment and that the effort was comparable between groups. In both environments, each visit started with a small meal followed by a simple breathing relaxation exercise, designed to foster a calm but alert state and, if necessary, avoid potential anxiety attacks during the stay in the environment. The meal and exercise were taken around a fire in the forest environment, and in a ring of chairs around a table in the handicraft environment. The participants then spent two hours engaged in simple activities in their environments. Examples of activities in the forest environment were walks, relaxation by the fire, woodcutting, gathering twigs and branches after forest clearance or relaxation in solitude in a preferred place. Activities in the handicraft environment included wood carving, varnishing and painting the resulting carvings, and simply relaxing in solitude in a secluded corner with a relax chair. All activities were voluntary, placing no demands on the participants. The main focus was on relaxation and restoration, rather than doing or producing. The fireplace in the forest environment and the coffee table in the handicraft environment provided focal meeting points where food and thoughts could be shared. At the end of every session the participants gathered and each had 2 min to talk about their experience of the day without interruptions from the other participants.

The forest and handicraft environments were respectively visited 8–22 and 7–23 times by individual participants (mean number of visits, 17, in both cases). A group leader was enrolled to provide support and qualified information about each environment. The group leader in the forest environment was a trained forester who had previous experience of working with people suffering from exhaustion disorder. The group leader in the handicraft environment had a background as an occupational therapist, teacher in a Rudolf Steiner nursery school and woodcarving teacher.

Table 1
Background of the participants (n = 46), with numbers and percentages of indicated groups (classified by gender, living conditions, highest education and occupation) who visited the forest and handicraft environments. Unemployed includes participants who were not working and some on work-practice. Sick leave includes participants who had retired early.

	Forest		Handicraft		Total	
	n	%	n	%	N	%
Number of participants	27	59	19	41	46	100
Sex						
Women	21	78	12	63	33	
Men	6	22	7	37	13	
Total	27	100	19	100	46	
Living conditions						
Living alone	6	22	6	32	12	
Living together with another adult	12	44	3	16	15	
Living together with another adult and children	3	11	8	42	11	
Living together with children	4	15	2	11	6	
Living together with someone else	2	7	0	0	2	
Total	27	99[b]	19	101[b]	46	
Highest education						
Secondary school	14	52	9	47	23	
University	13	48	10	53	23	
Total	27	100	19	100	46	
Occupation						
Sick leave	17	63	9	47	26	
Unemployed	5	19	3	16	8	
Working	3	11	6	32	9	
Studying	2	7	1	5	3	
Total	27	100	19	100	46	
	Years		Years		Years	
Age	47 (13)[a]		50 (11)[a]		48 (12)[a]	

[a] Standard deviation.
[b] Differs from 100% due to rounding errors.

2.4. Outcome measures

Psychological outcomes of the interventions were measured using a set of standard questionnaires (the Perceived Stress Questionnaire, Shirom-Melamed Burnout Questionnaire, Checklist Individual Strength questionnaire and Self-Concept and Short Form 36 survey, described below) and questions regarding medicine consumption, symptoms and sleeping patterns. The questionnaires were filled in at the start and end (after 3 months) of the intervention. In addition, immediate effects of the environments on mood, representing the restorative quality of the environments, were estimated by a short questionnaire before and after each visit.

2.5. Measurements at start and end of the study

2.5.1. Psychological outcomes

Fatigue: The Checklist Individual Strength (CIS) questionnaire estimates individuals' level of fatigue during the last 2 weeks. It consists of 20 statements designed to assess the subjective experience of fatigue, concentration, motivation, and level of physical activity on a 7-point scale from 1 to 7 where 1 represents the lowest level and 7 the highest. The composite total score represents the overall index. Low scores indicate low degrees of fatigue and concentration problems, with high levels of motivation and activity (Vercoulen et al., 1994). The CIS can discriminate persons with fatigue from persons with non-fatigue in a working population (Berursken et al., 2000).

Stress: The Perceived Stress Questionnaire (PSQ) estimates an individual's level of perceived generalized stress. It is composed of 30 statements with 4-grade response scales from 1 (almost never) to 4 (almost always). An index is calculated by subtracting 30 from the total score then dividing by 90, thus it ranges from 0 (no stress) to 1 (maximal stress) (Levenstein et al., 1993). Indices of 0.34-0.46 and > 0.46 are regarded as indicating moderately high and high stress levels, respectively (Bergdahl and Bergdahl 2002).

Self-esteem: The Self-Concept Questionnaire (SCQ) estimates people's level of self-esteem. Measures are significance, worthiness, competence, resilience and determination, appearance and social acceptability, control over personal destiny, and the value of existence. The questionnaire consists of 30 items scored from 0 (completely disagree) to 7 (completely agree). The composite total score was calculated. Higher total scores indicate higher self-esteem (Robson 1989).

Burnout: The Shirom-Melamed Burnout Questionnaire (SMBQ) consists of 22 items — rated from 1 (never or almost never) to 7 (always or almost always) — designed to estimate individuals' level of burnout, in terms of four subscales: emotional and physical fatigue, cognitive weariness, tension and listlessness. The result was calculated as mean values. (Melamed et al., 1999).

Self-reported health: The Short Form Health Survey *36* (SF-36) questionnaire consists of 36 questions, in several distinct sets intended to gauge individuals' self-reported health in terms of: physical functioning, role limitations due to physical health problems, bodily pain, social functioning, general mental health, role limitations due to emotional problems, vitality and general health (Ware and Sherbourne, 1992). A score on a scale from 0 (worst possible health state) to 100 (best possible health state) is calculated for each of these eight aspects (Sullivan et al., 1995). The result was calculated as mean values.

General disease symptoms were estimated by the numbers of self-reported symptoms of dizziness, headache, ache in neck and shoulders, ache in hands and arms, backache and ache in legs. The number of medicines used by the group in each environment was also estimated.

2.5.2. Physiological outcomes

Sleeping pattern of each participant was monitored using a wrist-worn Actiwatch from CamNtech Ltd (Cambridge, UK) and self-recorded in a sleep diary during three consecutive days and nights at the start and the end of the 3-month study period. The data were analyzed using Actiwatch Activity & Sleep Analysis software version 7.23 (Cambridge Neurotechnology). Four sleep parameters: total time in bed (from trying to fall asleep until getting out of bed); sleep latency (the time taken to fall asleep); total sleep duration (excluding periods of wakefulness during the night); and sleep efficiency (the percentage of time in bed spent sleeping) were derived from the Actiwatch recordings and sleep diary.

2.6. Measurements during the study period

2.6.1. Psychological outcomes

The mood of participants was estimated before and after each visit to their assigned environments in terms of perceived tension (tense-relaxed), fatigue (exhausted-alert), happiness (sad-happy), irritability (irritated-harmonious), restlessness (restless-peaceful) and clear-headedness (mentally divided-clearheaded) on a scale from 1 (negative) to 7 (positive). For these assessments we used a questionnaire based on the validated Profile of Mood States (POMS) and Zuckerman Inventory of Personal Reactions (ZIPERS) (McNair et al., 1971; Zuckerman 1977) instruments, which has been previously used in a rehabilitation study (Sonntag-Öström et al., 2011, 2015a).

2.6.2. Environmental outcomes

Perception of the environment: After each visit to their assigned environments, the participants also registered how they perceived the environment at that occasion. They answered twelve statements on a scale from 1 = completely disagree to 7 = completely agree. The statements were derived from the PRS scale (Hartig et al., 1996) and modified into the following simple statements: Here; is bright, all fits together naturally, I am protected from visibility, I have an overview, I feel safe, I release thoughts about routines, I can just be, I am a part of the whole, is space, something captures my attention, it is secretive and mysterious, it is simple and undramatic.

2.7. Environment descriptions

The forest environment was located in the boreal zone (Ahti et al., 1968) near lake Bäcksjön (coordinate system WGS 84: 63°58′ N, 20°21′ E) about 17 km from the city of Umeå in northern Sweden. The lake is approximately 3 km long, 1 km wide and surrounded by various types of forest and natural features with no settlements. The site where the participants spent most of their time was in boreal forest, managed according to standard practices in the area, dominated by pine (*Pinus sylvestris*), spruce (*Picea abies*) and scattered broadleaves, mostly birch (*Betula pubescens*). Light was measured at each visit with a Model 1300 light meter (Clas Ohlson, Sweden). The mean light intensity in the forest during the two intervention periods were 2780 lx (stand. dev. 3422 lx) in the autumn and 13734 lx (stand. dev. 8222 lx) in the spring. A "base camp" was established by a windshield with a hearth surrounded by big birch stumps that were used as seats during the meals and the breathing exercises (Fig. 1). The participants were given warm clothes, rubber boots, rain gear and a sleeping mat so they could be comfortable regardless of the weather and sit down on the ground to

Fig. 1. A: the 'basecamp' used for eating, breathing exercises and gathering at the end of each visit in the forest environment. B: view from the forest towards lake Bäcksjön.

Fig. 2. A: view from the coffee-table into the room in the handicraft environment. B: the corner for relaxation. C: carving fresh twigs. D: hangers resulting from the carving.

rest if they wanted.

The handicraft environment was located in a basement in Umeå, with a grey concrete floor and primrose walls (Fig. 2). Four windows were located close to the ceiling and cloths were used to divide the room into smaller areas. The mean light intensity in the room was 206 lx (standard deviation, 31 lx). It was sparsely furnished with a bench for sawing and drilling, a table for colouring, a storage shelf, a chopping block, and a circular table and chairs that were used during the meals and breathing exercises. The innermost part, separated by a cloth, was a place for rest with a comfortable chair. There was access to a toilet and a small kitchen.

2.8. Statistics

A power analysis before the study indicated that approximately 50 patients per group were needed for 90% power to detect a statistically significant difference ($P < 0.05$) in stress level indicated by mean PSQ scores between the forest and handicraft environment groups, assuming a mean difference in PSQ scores of 0.08 and a standard deviation of 0.12. Thus, with an expected dropout rate of 25%, 130 randomly assigned patients would be needed. However, due to new rehabilitation rules for people on sick leave there were difficulties in recruiting participants for the study since the tested interventions have not been accepted as proven rehabilitation methods. Eventually, 101 participants

were recruited and 46 completed the entire program.

2.8.1. Measurements at start and end of the study

The psychological outcomes: A non-parametric design for repeated measures, with "before/after" and occasion as within-subject factors and environment as a between-subject factor, was used in the statistical analyses of the participants' psychological outcomes. The analyses were performed using the%F1_LD_F2 SAS macro (Brunner et al., 2002; Shah and Madden 2004) in SAS version 9.3 (SAS Institute Inc., Cary, NC).

Physiological outcomes: The sleep data were analyzed by ANOVA with repeated measures, with time as a within-subject variable and location as a between-subject variable assuming that the data were normally distributed.

2.8.2. Measurements during the study period

Psychological outcomes – Mood: A non-parametric design for repeated measures, with "before/after" and occasion as within-subject factors and environment as a between-subject factor, was used in the statistical analyses of the participants' mood. The analyses were performed using the%F1_LD_F2 SAS macro (Brunner et al., 2002; Shah and Madden 2004) in SAS version 9.3 (SAS Institute Inc., Cary, NC).

2.8.3. Environmental outcomes

Perception of the environment: Differences in psychological outcome measures were analyzed using an ordinal logistic regression model, implemented in SPSS statistics software version 21 (SPSS Inc., Chicago, IL, USA), with a first-order autoregressive correlation structure to adjust for correlations within individuals over time.

Mean values and standard deviations of light in the forest environment during autumn and spring, as well as all presented graphs, were generated using Microsoft Excel 2010.

3. Results

3.1. Measurements at start and end of the study

3.1.1. Psychological outcomes

Fatigue, stress, self-esteem and burnout: The psychological tests showed that participants' health had improved after the interventions, i.e. visits to either the forest or handicraft environment (Table 2). More specifically, their levels of fatigue (CIS score), stress (PSQ score) and burnout (SMBQ score) were all lower. However, there was no significant improvement in their level of self-esteem (SCQ score).

Table 2
Participants' fatigue (CIS) total scores, stress (PSQ) index scores, self-esteem (SCQ) total scores and burnout (SMBQ) mean scores registered in psychometric tests before and after the 3-month intervention period with visits to the forest or handicraft environments (scores with standard errors in parentheses). P-values indicate significance of differences in scores between forest and handicraft environments (E), before and after the visits (BA), and interaction between E and BA (E*BA), respectively. n = 24 and 16 for participants who visited the forest and handicraft environments, respectively.

	Environment						
	Forest		Handicraft				
	Scores (se)				*p*-values		
	Before	After	Before	After	E	BA	E*BA
Fatigue	98.13 (4.38)	82.75 (4.68)	88.81 (6.90)	80.63 (6.51)	0.51	0.00***	0.37
Stress	0.60 (0.03)	“0.46 (0.04)	¤0.56 (0.04)	0.44 (0.04)	0.60	0.00***	0.81
Self-esteem	#129.68 (4.46)	132.17 (5.04)	¤118.00 (5.52)	121.06 (6.67)	0.14	0.21	0.94
Burnout	4.97 (0.21)	“4.60 (0.25)	4.69 (0.30)	4.37 (0.27)	0.47	0.00**	0.76

** = significant at $p < 0.01$, *** = significant at $p < 0.001$, “n = 21, #n = 22, ¤n = 14.

Table 3
Mean values before and after the 3-month intervention and statistical analyses are presented for the eight self-reported health concepts in SF-36; physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional and mental health. P-values indicate significance of differences between mean values where E = environment (forest and handicraft), BA = before and after the intervention period and E*BA is the covariance between E and BA.

	Environment						
	Forest		Handicraft				
	mean values				*p*-values		
	Before	After	Before	After	E	BA	E*BA
Physical functioning	86.25	86.04	86.56	85.31	0.73	0.76	0.28
Role physical	34.36	61.46	64.06	68.75	0.16	0.03*	0.07
Bodily pain	47.50	52.96	57.75	55.13	0.33	0.36	0.23
General health	47.92	54.04	55.50	59.00	0.33	0.01**	0.63
Vitality	27.29	40.21	34.36	41.25	0.50	0.00***	0.44
Social functioning	44.27	56.77	60.94	66.41	0.06	0.03*	0.29
Role emotional	37.50	48.61	54.16	54.17	0.40	0.38	0.38
Mental health	47.00	61.33	50.50	60.75	0.88	0.00***	0.51

*, ** and *** indicate significant differences at $p < 0.05$, $p < 0.01$ and $p < 0.001$, respectively.

Self-reported health: Several improvements in the health of participants who visited either environment were also detected, i.e. scores for several health aspects were significantly higher ($p < 0.05$) after the intervention (Table 3). More specifically, they felt less limitation in their daily life due to physical problems, considered their general health to have improved, did not feel so tired and worn out, noted that physical and emotional problems interfered less with normal social activities, and their mental health had improved so they felt happier and calmer.

We also tested for differences in general disease symptoms between participants who visited the forest and handicraft environments. A significant result was found only in number of medicines consumed, with fewer medicines after as compared to before the intervention period in both environments (Table 4).

3.1.2. Physiological outcomes

Sleep pattern: Sleep latency increased slightly (by 9 min, $p = 0.01$) among participants who visited the handicraft environment during the intervention, but it remained the same for those who visited the forest environment, and no significant effects of the visits were detected on any of the other sleep parameters (Table 5).

3.2. Measurements during the study period

3.2.1. Psychological outcomes

Mood: After a visit to either environment, the participants felt more relaxed, alert, happy, harmonious, peaceful and clearheaded than before the visit. Over time, they also felt significantly more clearheaded (Fig. 3 and Table 6).

Aggregated mood: A visit to either environment improved the participants' aggregated mood (measured using the instrument described above, as a combined value for the relaxed, alert, happy, harmonious, peaceful and clearheaded dimensions for all participants), as shown in Fig. 4. The aggregated mood increased from before, to after, each visit (BA) to the environment ($p < 0.001$). No difference in aggregated mood could be found for participants assigned to either the forest or the handicraft environments (E), nor was there a change in aggregated mood for them over time during the three months intervention (VN) (Table 7).

Table 4
Number of participants who suffered from stress-related symptoms (dizziness, headache, ache in neck and shoulders, ache in hands and arms, backache and ache in legs) during the last three months and the total number of medicines used by the group in each environment. P-values for the variables E = environment, BA = before compared to after the intervention period, and E*BA = interactions between the two variables.

	Number of participants (n)							Tot no. of group
Environment	Diz-ziness	Head-ache	Ache neck, shoulder	Chest ache	Ache hand, arm	Back-ache	Ache leg	Medicines
Forest before	16	19	20	14	14	19	14	68
Forest after	12	18	18	12	16	17	12	60
Handicraft before	6	14	14	5	6	9	8	40
Handicraft after	7	13	15	7	7	8	10	30
p-values								
E	0.23	0.54	0.28	0.14	0.14	0.11	0.88	0.93
BA	0.48	0.28	0.81	0.91	0.30	0.39	0.83	0.005**
E*BA	0.12	0.83	0.095	0.44	0.88	0.90	0.28	0.059

** significant difference, *p*-value < 0.01, n in forest = 24, n in handicraft = 14.

Table 5
Differences in participants' sleep parameters derived from Actiwatch recordings and a sleep diary before and after the 3-months intervention period with visits to the forest or handicraft environments. P-values indicate significance of differences in scores between forest and handicraft environments (E), before and after the visits (BA), and interaction between E and BA (E*BA), respectively.

	Environment (minutes)		(*p*-values)		
	Forest (n = 24)	Handicraft (n = 12)	E	BA	E*BA
Time in bed	+00:22:58	+00:15:18	0.59	0.06	0.39
Actual sleep time	+00:08:17	−00:12:12	0.44	0.50	0.96
Sleep efficiency	−1.04	−1.55	0.51	0.49	0.89
Sleep latency	+00:05:05	+00:09:11	0.01*	0.63	0.02*

* significant at $p < 0.05$.

3.2.2. Environmental outcomes

Perception of the environment: The participants perceived that everything fitted together more naturally in the forest than in the handicraft environment, and the forest was more secretive and mysterious (Table 8). However, they felt equally safe in both environments.

4. Discussion

The participants in the present study visited either an outdoor forest or an indoor handicraft environment to alleviate stressymptoms. Both environments included similar activities, starting with a gathering with a small meal, followed by a short breathing relaxation exercise, two hours of voluntary activities or just relaxation, and ended with a gathering.

The forest environment has earlier, in comparison to the city, been shown to be more undemanding and restorative already after a short visit and thereby contributing more to restoration and lower heart rate for persons with chronic fatigue syndrome (Sonntag-Öström et al., 2014). Persons with chronic fatigue did not recover enough to return to work after a three-month period of visits to forest environments. However, they were able to take hold of their lives and begin to plan for the future (Sonntag-Öström et al., 2015a,b). In line with these findings, the results in the present study show that spending time in the forest during a three-month period has restorative effects for people suffering from high stress. However, the handicraft environment offered similar restorative effect. After the intervention period participants in both environments had lower levels of fatigue, stress and burnout. Obviously the green forest environment was not better than the indoor environment at reducing stress. This conflicts with our hypothesis that nature in the form of an outdoor forest environment would promote recovery from stress better than an indoor environment, in accordance with previous findings that forest visits have strong restorative qualities (e.g. Kaplan and Kaplan 1989; Grahn and Stigsdotter 2003). However, many studies compared visits to forests (and other natural environments) with visits to urban environments, rather than other potentially restorative environments (Sonntag-Öström et al., 2014; Ulrich et al., 1991).

We hypothesized that the activities in the indoor environment, which offered voluntary simple woodcarving, and the activities in the forest environments were equally restorative. Leisure and meaningful occupation are restorative experiences (Newman et al., 2014) which may have influenced the result. However, many of the participants had such a high stress level that an extra activity (as participating in the study) was hardly seen as a leisure activity. The participants in the handicraft environment, as well as those in the forest environment, were not obliged to perform any activities at all. They could just sit and rest if they so wished. When designing the study our objectives were to characterize the restorative potential of a green boreal forest and compare its effects with a non natural environment with similar caractheristics. We were not interested in having a control group consisting of patients receiving standard care with medication for their stress symptoms, or spending the same amounts of time in an environment known to be non-restorative and more stressfull (such as most urban environments). Thus, we chose a non-green indoor environment as the control, and included voluntary similar activities in both environments. Therefore, study was designed to compare the two different restorative environments. As far as we know, no previous study has explicitly compared a forest and a handicraft environment and their restorative effect on people with high stress levels.

Although there were no significant between-environment differences, it is important to note that both groups, regardless of environment, improved their health. The participants' self-reported health (physical role functioning, general health, vitality, social functioning and mental health measured by SF-36) as well as their general and mental health (level of fatigue, stress and burnout) improved during the 3-month intervention, showing that the visits to the forest or the handicraft environments improved almost all dimensions of the participants' health.

The intervention had little apparent effect on the participants' sleeping patterns. The only significant difference detected was that the sleep latency of those who visited the handicraft environment significantly increased, by 9 min on average. Longer sleep latency is indicative of increased stress, poor sleep overall and (hence) lower quality of life (LeBlanc et al., 2007; Andruskiene et al., 2008; Åkerstedt et al., 2014). However, we consider the 9 min increase to have been of minor importance in the context of the wider improvements in participants' health and mood, particularly as there were no other indications that the intervention impaired sleeping patterns.

The results thus show that regular visits to a forest improved the mood of people with high stress levels, in accordance with previous findings that visits to forests and other natural environments enhance both psychological and physiological recovery (e.g., Korpela et al., 2014; Sonntag-Öström et al., 2014). However, similar improvements in

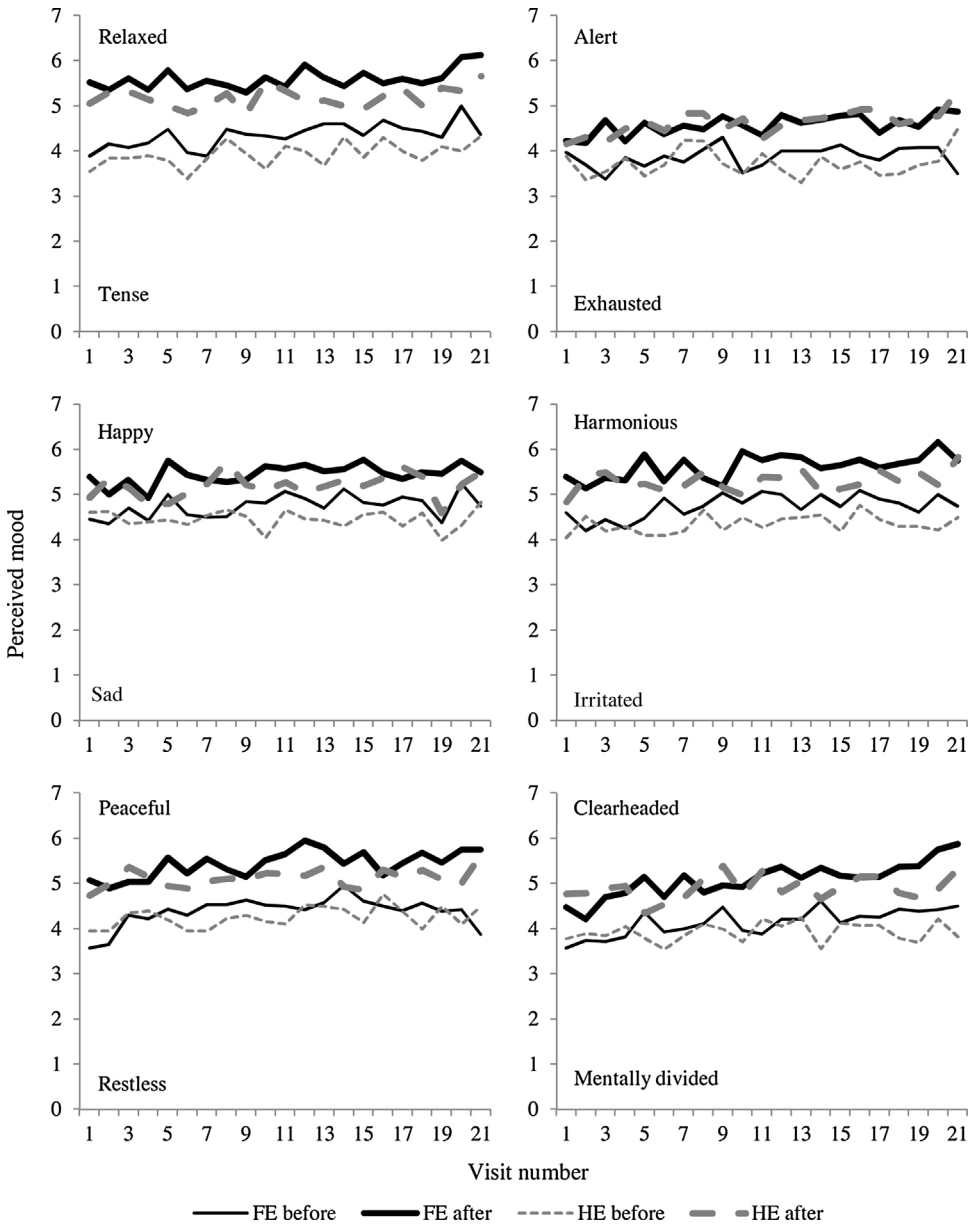

Fig. 3. The participants' perceived mood before and after visits to the forest (FE) or the handicraft environment (HE), where 1 indicate the worst possible mood and 7 indicate the best possible mood. The mood was registered in questionnaires at each visit. n = 46.

Table 6
Significance of differences of participants' perceived mood, registered in questionnaires at visits to the two environments, where E = Forest or Handicraft environment, VN = number of visit, and BA = mood before and after each visit. E*BA, E*BA, VN*BA and E*VN*BA indicate interactions between these variables. N = 46.

	Relaxed	Alert	Happy	Harmonious	Peaceful	Clearheaded
p-values						
E	0.10	0.97	0.16	0.08	0.39	0.32
VN	0.21	0.51	0.72	0.64	0.19	0.05*
BA	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
E*VN	0.94	0.73	0.73	0.64	0.60	0.26
E*BA	0.95	0.50	0.82	0.89	0.56	0.80
VN*BA	0.16	0.37	0.96	0.36	0.13	0.56
E*VN*BA	0.77	0.72	0.50	0.83	0.79	0.64

* significant at $p < 0.05$.
*** significant at $p < 0.001$.

mood were observed among the participants who visited the handicraft environment. The simple instrument used for measuring mood was constructed by the research team, and has earlier been applied in studies on forest rehabilitation of persons with exhaustion disorder (m et al., 2011, 2014, 2015a; m et al., 2011, 2014, 2015a; m et al., 2011, 2014, 2015a). It is based on validated instruments such as Profile of Mood, POMS, (McNair et al., 1971) and Zuckerman Inventory of Personal Reactions, ZIPERS, (Zuckerman, 1977), and is short and simple in order to minimize the mental effort of participants with exhaustion disorder.

The health indicators (CIS, PSQ, SMBQ and 5 health concepts in SF-36) and mood (clearheaded) of the participants who visited the two environments improved equally well during the intervention period, with extremely few significant differences (9 min in sleep latency and two variables in perceptions of the environment) between the two groups. Since we recruited fewer participants than the threshold for statistical power calculated before the study it is possible that greater differences may have emerged if the sample size (number of participants) had been larger. It is also possible that the intervention should have been longer as, e.g., Karlson et al. (2010) have shown that people suffering from burnout need substantial time to recover before they can successfully return to work. In the cited study only 73% of the participants had returned to work (partially or fully) after 18 months of

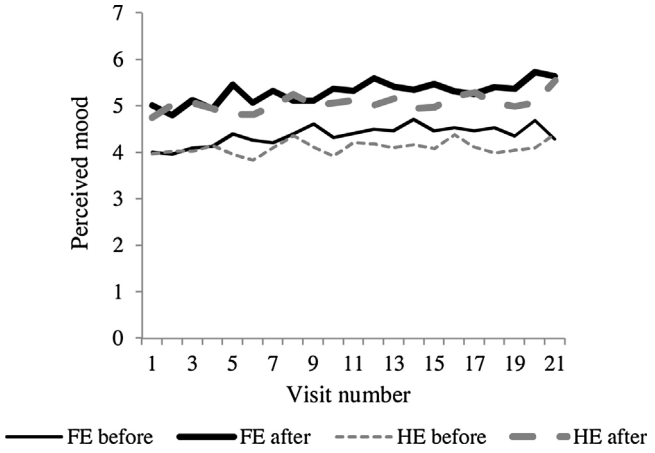

Fig. 4. Mean values of the participants aggregated perceived mood before and after visits to the forest (FE) and handicraft environments (HE), where 1 indicate the worst possible mood and 7 indicate the best possible mood. The aggregated mood is calculated as a combined value for the relaxed, alert, happy, harmonious, peaceful and clearheaded dimensions. N = 46.

Table 7
Significance of differences in participants' aggregated perceived mood after visits to the two environments and interactions between variables. The aggregated mood is calculated as a combined value for the relaxed, alert, happy, harmonious, peaceful and clearheaded dimensions.

	Aggregated mood (*p*-values)
E Forest or Handicraft environment	0.27
VN Number of visit	0.15
BA Mood before and after each visit	0.00***
Interaction between E and VN	0.81
Interaction between E and BA	0.84
Interaction between VN and BA	0.49
Interaction between E and VN and BA	0.83

*** significant at $p < 0.001$.

Table 8
Mean scores of participants' perceptions of the forest and handicraft environments registered in questionnaires at each visit to the environment, where 1 = completely disagreed and 7 = completely agreed. P-values indicate the significance of differences in perceptions between the two environments.

	Environment		
	Forest	Handicraft	
How the environment is perceived	mean values		*p*-values
It is bright	5.8	5.0	0.100
All fits together naturally	6.2	5.4	0.008**
Protected from visibility	5.3	5.7	0.283
I have an overview	5.6	5.9	0.383
I feel safe	6.1	6.1	0.934
I release thoughts about routines	5.3	5.7	0.097
I can just be	6.3	6.2	0.227
I am a part of the whole	6.1	5.6	0.064
Here is space	6.4	6.0	0.076
Something captures my attention	5.7	6.0	0.280
It is secretive and mysterious	4.4	2.7	0.002**
It is simple and undramatic	6.0	6.1	0.941

** = significant at $p < 0.01$.

intervention. It should also be noted that participants in the present study included people who were moderately stressed, rather than solely those who were severely stressed, according to the PSQ-scale. Nevertheless, the indications that the two environments were approximately equally restorative seem robust, and are the most intriguing results.

The findings indicate that both environments fulfilled the four criteria listed by Kaplan and Kaplan (1989) for an environment to be restorative: giving a feeling of being away, having extent, creating fascination, and being compatible with the participants' intentions. The first criterion, being away, represents an escape from everyday life through separation by either geographic distance or psychological distinctions from a person's normal environment. In the forest the participants probably felt being away since they experienced a different environment, offering simple activities, while the participants in the handicraft environment may have felt being away by the undemanding wood carving. In the same way the effortless activities in both environments provided extent. Extent refers to an environment offering a context where people feel they belong and inducing a desire to explore, accompanied by an effortless and soft fascination that allows their thoughts to wander away. We consider that the two environments with their undemanding comparable activities were not imposing obstacles to the participants intentions (Kaplan 1995). Both environments were considered to be restorative and to foster positive emotions in the beholder (van den Berg et al., 2003). To sum up; both the studied environments, including the similar activities provided in our intervention, presumably fulfilled these criteria and signalled coherence, recognition and safety, all of which contributed to the restorative effect.

4.1. Limitations of the study

We can't ignore, though, that natural recovery over time could be responsible for the participants health changes from the first to the last session of the interventions. It can be as simple as to be included in a social context contributes to recovery from stress. There is also a possibility that the two group leaders could have influenced the participants and thereby the results of the study. The participants may, e.g., have been motivated to 'reward' the leaders by rating their well-being more highly at the end of each visit. We can't ignore this fact, but we think that the impact of the leaders was of minor importance as they were instructed to be passive and interfere with the participants as little as possible. However, we could not prohibit the participants to interact with each other and therefor the social support by the group may have had some influence on the results.

The sample size was smaller than required by the power analyses, which may have affected reliability of the result. The small sample size was the result of newly imposed governmental rules for sick leave and rehabilitation which entailed problems for us to find the desired number of participants.

In an earlier study where patients with exhaustion disorders spent time in different forest settings (Sonntag-Öström et al., 2015a), the control condition implied care-as-usual. Thereby we did not know the participants daily activities. It was found that patients in the control group participated in alternative treatments at a larger degree compared to the intervention group which may have influenced the result. In the present study we found it necessary to find control conditions comparable to the forest conditions. However, a control condition, in addition to the forest and the handicraft environments, implying care-as-usual would probably have given more reliable results.

The leaders were told to keep a low profile and not initiate discussions. Even though the group was not encouraged to socialise, the social aspect, like the support the participants gave to each other, could not be controlled for. However, in a similar project the participants reported that the time in solitude in a chosen forest environment was more important to them than the gatherings around the fire (Sonntag-Öström et al., 2015b). Those findings would indicate that the time spent in the environment with the selected activities would have been of larger importance to the results of the present study as compared to the social aspect.

However, characteristics of environments that promote calmness and restoration among the rising numbers of persons with high stress levels clearly require further elucidation as provision of a good restorative environment may be a highly cost- and time-effective

rehabilitation and/or prevention solution. More long-term studies are also needed, for instance on the participants' health status in years following the intervention.

Qualitative research to uncover participants' own views of e.g. the benefits derived from the environments, their accompanying set of activities and the impact of the social support by the group has been performed. The results will be presented in a coming paper which will then give further information to the questions addressed in the study.

5. Conclusion

The health of the participants who visited either the outdoor forest environment or the indoor handicraft environment significantly improved during the intervention period. Whether an environment, including activities, is indoors or outdoors appears to be less important for restoration than other aspects, such as coherence, appeal and/or the degree and nature of demands. Even an indoor environment with suitable activities can act restorative. However, the key restoration-promoting features require further elucidation.

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